

Running Head: ANALYSIS OF 9-1-1 CALL PROCESSING TIMES

Analysis of 9-1-1 Call Processing Times for Emergency Medical Services

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Certification Statement

I hereby certify that this paper constitutes my own product, that where language of others is set forth, quotation marks so indicate, and that appropriate credit is given where I have used the language, ideas, expressions, or writings of another.

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Abstract

The Montgomery County Fire and Rescue Service (MCFRS) has failed to meet established goals for 9-1-1 call processing times for emergency medical services (EMS). The purpose of this applied research project was to ascertain the magnitude of this failure and to determine the impact on the delivery of emergency medical services. The descriptive research method was used for this applied research project, which involved an analysis of data from the computer-aided dispatch (CAD) and Medical Priority Dispatch System (MPDS) data warehouses and benchmarking performance against published standards and neighboring jurisdictions. The research questions were: what are the applicable standards and regulations on 9-1-1 call processing times for emergency medical services, what are the current 9-1-1 call processing times for emergency medical services in Montgomery County, how does call-taker compliance with the MPDS protocols affect 9-1-1 call processing times, how do the 9-1-1 call processing times affect the overall emergency medical services response times, and how do the 9-1-1 call processing times in Montgomery County compare to those of other jurisdictions in the National Capital Region (NCR)? The results showed that when call processing was measured against National Fire Protection Association (NFPA) standards for time-critical ALS events, the 90% fractile call processing time was 183 seconds. Call-taker compliance with MPDS protocols had no effect on call processing times. Failure to meet call processing time standards led to the failure to meet total ALS response time standards for 14% of ALS events. While some NCR jurisdictions do not measure call processing times, those that did were up to three times faster than MCFRS. It was recommended that MCFRS begin measuring call processing against the NFPA standards, conduct a workflow mapping and analysis of the call taking process, reevaluate the use of the MPDS product, plan for a new CAD, and reevaluate the EMS deployment strategy.

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Analysis of 9-1-1 Call Processing Times for Emergency Medical Services

In 2007, the new County Executive for Montgomery County, Maryland implemented an initiative called *CountyStat* that addresses a priority of his administration – a “responsible and accountable County Government” (Montgomery County Government, 2009a, p. 1). Each county agency is required to focus its management activities on being responsible and accountable to its customers. The Montgomery County Fire and Rescue Service (MCFRS) developed *Response Time to Advanced Life Support and Structure Fire Incidents* as one of its performance measures for CountyStat. MCFRS set the goals of an 8-minute overall response time for the paramedic unit to arrive at advanced life support (ALS) incidents and a 6-minute overall response time for the first arriving engine company at structure fires. Taking into account travel time and turnout time for the first arriving units, these goals allot the communications center with less than one minute to process 9-1-1 calls and dispatch these ALS and fire events; though it is well known that the communications center is hindered by “time-consuming [State-mandated] protocols...and a cumbersome computer-aided dispatch system” (Montgomery County Government, 2009b, p. 1).

The problem studied for this applied research project is that the MCFRS Emergency Communications Center (ECC) fails to meet established goals for 9-1-1 call processing times for emergency medical services. For purposes of this applied research paper, the term *9-1-1 call processing time* will refer to the interval from Fire-Rescue ECC receipt of the 9-1-1 telephone call from the Public Safety Answering Point (PSAP) to the dispatch of the event via the Computer-Aided Dispatch (CAD) system. The current 9-1-1 call processing times are considerably longer than the established goals, and have consistently failed to meet these goals since the implementation of the Medical Priority Dispatch System (MPDS).

The purpose of this applied research project is to ascertain the magnitude of this failure to meet established goals for 9-1-1 call processing times and to determine the impact of this failure on the overall delivery of emergency medical services, thus leading to the development of improvement strategies.

For this applied research project, the descriptive research method is used, which involves an analysis of data from the CAD and MPDS data warehouses, as well as benchmarking performance with other jurisdictions. The research questions are: what are the applicable standards and regulations on 9-1-1 call processing times for emergency medical services, what are the current 9-1-1 call processing times for emergency medical services in Montgomery County, how do call-taker compliance levels with the MPDS protocols affect 9-1-1 call processing times, how do the 9-1-1 call processing times affect the overall emergency medical services response times, and how do the 9-1-1 call processing times in Montgomery County compare to those of other jurisdictions in the National Capital Region?

Background and Significance

The first fire and rescue dispatch services were provided in Montgomery County in 1952 by *Fireboard 1*, serving the volunteer fire companies of the upper county, and later in 1958 by the addition of *Fireboard 2*, serving the fire companies of the urbanized lower county (Marcopoulus, n.d.). In 1964 the county government combined these two centers into a new *Emergency Operating Center* (EOC) under the auspices of the county's Department of Fire and Rescue. That year, the EOC dispatched 25,925 calls for service, which included 16,960 emergency medical services calls. Over the ensuing years, the EOC evolved into the *Emergency Communications Center* (ECC) with advances in technology including the enhanced 9-1-1 system, computer-aided dispatch (CAD) and two-way radio systems.

In July of 2003, the ECC moved to a new building, the state-of-the-art Public Safety Communication Center (PSCC). In addition to the Fire-Rescue ECC, the PSCC would be the home for the PSAP, the County Police ECC, Traffic Management, Homeland Security and the Emergency Operations Center (EOC). This move was part of a 21st Century information technology project called Public Safety 2000 (PS2000), which would bring an integrated Altaris CAD system, a computer-controlled trunked 800 MHz radio system for county public safety agencies, and computerized, state-mandated Emergency Medical Dispatch (EMD) protocols (i.e., MPDS). These new technologies were needed to provide improved services to the county, with fire and rescue emergency events reaching 100,000 per year and increasing by 10% per year corresponding with population growth.

The *Fire, Rescue, Emergency Medical Services, and Community Risk Reduction Master Plan* (henceforth called the *Master Plan*) defines EMD as a “system designed to provide customer uninterrupted medical attention from the initiation of the 9-1-1 call, up to and including the arrival of, and subsequent treatment by, emergency medical providers” (Montgomery County Fire and Rescue Commission [MCFRC], 2005. p. 4-6). Maryland state law, under the Code of Maryland Regulations (COMAR) Title 30 (2009b) requires that each Jurisdictional EMS Operational Program in Maryland use an EMD system that is approved by the Maryland Institute for Emergency Medical Services Systems (MIEMSS). At the time PS2000 was developed the only computerized EMD program authorized by MIEMSS was the MPDS.

The new technology of the PS2000 system inadvertently produced a significant increase in call processing times. Anecdotal accounts from telecommunicators over the past six years point to the new CAD, and its use of the MPDS, as the culprit. Prior to the move to the PSCC, there was no record kept of the *9-1-1 to pending interval*, the time from receipt of the 9-1-1

telephone call to sending the event to the dispatcher's pending screen. So unfortunately, these anecdotal accounts cannot be corroborated. But what is known is the change in the *pending to dispatch interval*, the time from receipt of the event on the dispatcher's pending screen to dispatch of the fire and rescue units. The average pending to dispatch interval prior to the move to the PSCC was 39 seconds (Montgomery County Fire and Rescue Service [MCFRS], 2008). After the move, the average pending to dispatch interval increased by 161% to 63 seconds. Worse, the pending to dispatch interval for structure fires increased by 230% to 90 seconds (MCFRS, 2008). Overall 9-1-1 call processing performance did not improve in subsequent years, as the 1-minute goal remained elusive.

The definition of *response time* is the "elapsed time from the initiation of a call to 9-1-1 to the arrival of appropriate units" (MCFRC, 2005, p. 1-10). Many MCFRS documents have provided differing versions for response time goals, making the analysis of performance even more difficult. The most recent version of the *Master Plan*, published in 2005, speaks of previous iterations of response time goals as not being mandatory standards, but rather intended to be used to establish locations for new fire stations and to assign apparatus and personnel to the most appropriate locations (MCFRC, 2005). The example given for establishment of ALS service was meeting both an 8-minute response 90% of the time and a 6-minute response 50% of the time (MCFRC, 2005). The *Master Plan* defines *ALS response time* as being *travel time* for an ALS unit to an ALS incident, which exemplifies the variation amongst definitions of time measurement. Later in the *Master Plan*, National Fire Protection Association (NFPA) standard 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, And Special Operations to the Public by Career Fire*

Departments, was referenced to define ALS response times as 8 minutes to 90% of incidents (MCFRC, 2005).

The *Master Plan* also provides a historical review of how the definitions of response times were set using separate measurements for urban, suburban and rural areas of the county, with a 6-minute ALS response time goal, but differing fractile percentages for urban (95%), suburban (90%) and rural (50%). These goals have been set to match response time to the specific population density in the different areas of the county and to “better allocate...resources to meet the needs of the public throughout areas of varying density” (MCFRC, 2005, p. 1-12).

Confusing definitions and applications of ALS response times notwithstanding, the *Master Plan* does reaffirm that one of the goals of the MCFRS must be an improvement in response time goals. The plan recommends that the ECC “strive to process all requests for emergency services within one minute” and “develop and implement measures that will speed the processing of 9-1-1 callers’ requests for service and the dispatch of MCFRS apparatus” (MCFRC, 2005, p. 5-49). Further recommendations on the use of EMD state that MCFRS should “evaluate on an ongoing basis the effect of EMD on MCFRS-wide resource deployment and availability” and “evaluate on an ongoing basis the time required of Emergency Medical Dispatchers to execute EMD protocols, and determine its impact on [ECC] staffing needs” (MCFRC, 2005, p. 5-49).

To add more confusion, the *Master Plan* then redefines response time by setting new goals that the “MCFRS adopt the revised and expanded response time goals...based upon modified density zones” (MCFRC, 2005, p. 5-51). The ALS response time was now eight minutes with differing fractile percentages for urban (95%), suburban (80%) and rural (45%). These new density zones were established using the following factors: “population density,

building density, future population projections, zoning, fire hydrant coverage, distance to urban core, and distance to interstate highways” (MCFRC, 2005, p. 5-51).

The *Master Plan* does provide two reasons previous response time goals were not being met. First, there has been a lack of apparatus and personnel resources, which have not “kept pace countywide demands for service,” and second, there are response areas with extended travel times due to “long distances between fire-rescue stations” (MCFRC, 2005, p. 5-57).

In 2007, MCFRS applied for accreditation with the Centers for Public Safety Excellence (CPSE). The CPSE provides emergency services agencies with tools to “achieve excellence through self-assessment and accreditation in order to provide continuous quality improvement and the enhancement of service delivery” (Knight, 2007, p. 2). While MCFRS did achieve accreditation under the 6th edition of the *Fire and Emergency Services Self-Assessment Manual*, the accreditation report states that MCFRS “must spend considerable effort to bridge the gap between current baselines and objectives, and the goals in the 10-year master plan” (p.6). The report recommends that MCFRS redefine the service level goals set below the 70th percentile, such as the rural ALS response time goals.

The accreditation report recommends that MCFRS conduct an analysis of call processing procedures, with a focus on alternative methods of utilizing EMD (Knight, 2007). MCFRS was also advised to review its tiered response strategy for EMS events, and to consider responding to all EMS events as if they were the highest priority event (ALS) to eliminate the delays in EMD prior to dispatch. Even with these recommendations embraced, MCFRS would be “distant from obtaining...strategic goals for service level objective such as response time” (p. 21) because, in part, of MCFRS internal processes and policies that have provided the delays in call processing.

For the 2008 and 2009 CPSE compliance reports, MCFRS provided some strategies to meet the 2007 accreditation report's recommendations. MCFRS reported actual ALS response times for the current year as 10 minutes for 75% of urban, 63% of suburban and 35% of rural ALS responses (Harrigan, 2008). Once again, the response time goals were redefined, this time with MCFRS stating that the percentages for each response zone will be increased to 90% urban, 75% suburban and 50% rural. MCFRS further reports that it has met all response time goals for critical events, with the exception of meeting its 1-minute call processing time (MCFRS, 2009). The CAD system is blamed for this failure, and a new CAD system is foreseen as being able to speed up the call processing and dispatch times. A new CAD will "allow ECC personnel to process 9-1-1 calls and dispatch units considerably faster; thus reducing the component of response time that is preventing MCFRS from meeting many of the response time goals established in the MCFRS master plan" (Harrigan, 2008, p. 19).

MCFRS developed several performance measures for the CountyStat program, including *Response Time to Advanced Life Support and Structure Fire Incidents*. These program measures are reviewed by the County Executive, Chief Administrative Officer, and all of the County Department Heads on a regular basis, where real-time data is used to analyze performance and to develop targeted action plans for improvement. The initial status of this performance measure was presented using the same three population density zones from earlier plans, but yet again changed the fractile percentages to 95% urban, 90% suburban, and 50% rural (Montgomery County Government, 2009b).

The MCFRS fire chief's draft *FY10 Strategic Plan for Implementation of Fire, Rescue, Emergency Medical Services, and Community Risk Reduction Master Plan Priorities* (hereafter referred to as the *Strategic Plan*) is a document prepared annually to assure a strategic-level

alignment with the current *Master Plan* (Gutschick, 2998) . These strategic priorities bring alignment to the *Master Plan*, the accreditation process and the CountyStat performance measures. The *Strategic Plan* lists *ECC Call-Processing Time Reduction* as the second highest priority for MCFRS.

The *Strategic Plan* states that “accelerating ECC’s call-taking and dispatch process is essential to reducing response times” because call-processing “offers the best opportunity for significant reductions” in overall response times (Gutschick, 2008, p. 5). The *Strategic Plan* calls for implementing technological, staffing and procedural changes as outlined in a 2009 ECC analysis. Suggested approaches include improved technologies such as a new CAD, changes in operational procedures, and increasing staffing at the ECC to include the addition of civilian call taker positions.

In the *Communications Section White Paper*, Kang (2008) outlines several impediments to call processing efficiency. First, cellular communications has caused a capacity issue, where one incident may yield multiple cellular phone calls to be handled by call takers. Additionally, with the use of cellular phones, the benefits of E9-1-1 are negated. Second, the EMD process is not flexible, by way of the MPDS software’s inability to be modified by the user and many callers become frustrated with the questions asked, thus delaying the processing time. Third, the current CAD is inadequate in that it did not streamline resource allocation, nor did it deliver the capacity to manage MCFRS resources.

The increase in 9-1-1 call processing time since the implementation of PS2000 has had a significant organizational impact, and there is sufficient justification for this study. Prior to the MPDS, MCFRS telecommunicators were able to quickly process and dispatch calls for emergency medical services. Once the new CAD and MPDS were activated, there was every

indication that the new technology had slowed down the process, yet no analysis of the root cause of this problem was initiated. Because this problem was not critically examined, overall response times for ALS medical services and structure fires have been adversely affected. The *Master Plan* recommends that the effect of EMD on resource deployment be evaluated (MCFRC, 2005). The CPSE recommends that MCFRS analyze call processing with a focus on the effects of EMD on its response strategies (Knight, 2007). Kang (2008) alludes to the inflexibility of EMD as an impediment to call processing efficiency. Clearly, the slow call processing times attributed to EMD has and will continue to impact overall response times.

More recently, the Montgomery County Council has become concerned with the poor response time performance of MCFRS, becoming increasingly inquisitive about the processes at the Fire-Rescue ECC. With a new Fire Chief in place, along with a new Operations Division Chief and a new ECC Section Chief (the author), recommendations for conducting a critical analysis of call processing and EMD have finally been heeded. Concurrent with this applied research project, a strategic planning study for a new CAD system has been completed, and task orders for request for proposals (RFP) are being prepared for a mapping and strategic analysis of the work-flow of the call taking and dispatch functions.

Ideally, there are benefits from solving the problem of poor 9-1-1 call processing times. Saving a few minutes, and thereby moving closer to the 1-minute goal, should reduce the overall ALS response time and provide ALS to patients quicker, possibly reducing mortality and morbidity rates in Montgomery County.

This applied research project is consistent with the United States Fire Administration's (USFA) operational objectives, most significantly the forth goal, "to promote within communities a comprehensive, multihazard risk reduction plan led by the fire service

organization” (United States Fire Administration [USFA], 2008a, p. II-2). Reducing 9-1-1 call processing times and thereby overall response times to ALS emergencies is a significant part of risk reduction within the community. Ideally, the faster responders can arrive on the scene of an ALS emergency, the more likely there to be a successful patient outcome. This applied research project is also consistent with the USFA’s fifth goal, “to respond appropriately in a timely manner to emerging issues” (p. II-2). With the publication of the 2010 editions of NFPA 1710 and 1221, the fire service will be held more accountable to the components of response time standards. The new USFA strategic plan lists as one of its goals to improve local planning and preparedness. This applied research project meets this goal by “enhance[ing] the fire and emergency services’ performance in response to all hazards” (USFA, 2008b, p. 7).

This applied research project is also consistent with the Executive Fire Officer course Executive Analysis of Fire Service Operations in Emergency Management (EAFSOEM). The goal of EAFSOEM is to “prepare senior fire officers in the administrative functions necessary to manage the operational component of a fire department effectively” (USFA, 2009, p.1-3). Clearly, information on the 9-1-1 call processing time delays in Montgomery County and recommendations presented in this applied research project may help other senior fire officers provide more effective and timely emergency response to critical community risks.

Literature Review

The NFPA provides consensus standards for the fire service on a multitude of topics, including emergency communications and dispatch services. NFPA 1221, *Standard for the Installation, Maintenance, and Use of Emergency Services Communications Systems*, establishes 9-1-1 call processing times. The standard’s purpose is to “provide requirements for dispatching of appropriate emergency response personnel” and “to establish the required levels of

performance...of emergency services communications systems” (NFPA, 2009a, p. 5). This standard only addresses the handling of *alarms* (i.e., 9-1-1 calls), stating that “90% of emergency alarm processing shall be completed within 60 seconds, and 99% of alarm processing shall be completed within 90 seconds” (p. 15). As is the case in Montgomery County, when an alarm is transferred from a PSAP, the transfer procedure “shall not exceed 30 seconds for 95% of all alarms processed” (p. 15). The statistical analysis of these alarm processing times is to be presented on a monthly basis. NFPA 1221 also allows certain types of 9-1-1 calls to be excluded from the above time requirements. These exempted 9-1-1 calls, such as those requiring a language line translator or telecommunications devices for the deaf (TTY/TDD) are known to take extra caller interrogation and thus more time. Other jurisdiction-defined exclusions are also allowed.

NFPA 1710, *Standard for the Organization and Deployment of Fire Suppression Operations, Emergency Medical Operations, and Special Operations to the Public by Career Fire Departments*, specifies “the minimum criteria addressing the effectiveness and efficiency” of fire service organizations (NFPA, 2009b, p. 4). This document establishes overall response time requirements. NFPA 1710 defines *alarm processing time* (i.e. call processing time) as “the time interval from when the alarm is acknowledged at the communication center until response information begins to be transmitted via voice or electronic means to emergency response facilities and emergency response units” (p. 7). This standard requires fire departments to establish alarm processing times of “not more than 60 seconds for at least 90% of the alarms and not more than 90 seconds for at least 99% of alarms” (p. 7).

NFPA 1710 also requires fire departments to establish response time interval objectives. These intervals make up the *total response time*, as defined by NFPA 1710 to be “the time

interval from the receipt of the alarm at the primary PSAP to when the first emergency response unit is initiating action or intervening to control the incident” (NFPA, 2009b, p. 7). The NFPA requires that this data be evaluated on a monthly basis, and that evaluation “shall be based on emergency incident data” and the 90% objective should only “be evaluated against emergency incident response” (p. 7). “The collection of data is required to determine the organization’s ability to meet its locally determined objectives and the performance objectives contained in the standard with regard to emergency incidents (warning lights and sirens)” (p. 7).

NFPA 450, *Guide for Emergency Medical Services and Systems*, defines *call processing* as the “total time from call intake by...dispatching agency to response unit notification” (NFPA, 2008, p. 11). Later in the standard, *call processing* is defined as the “process that begins with the telephone first rings at the first PSAP and ends when responding units *acknowledge* [emphasis added] that they are aware of the event” (p. 14). This definition contradicts the alarm processing time definition in NFPA 1221 and NFPA 1710, but the metric is referred back to NFPA 1221 and stated as “dispatch of emergency response aid should be made within 60 seconds of the completed receipt of an emergency alarm” (p. 14).

The American Society for Testing and Materials Committee F30 on Emergency Medical Services develops standards for EMS systems. Several standards are applicable to MCFRS, including those on telecommunications, emergency medical dispatch, 9-1-1 telephone systems, training and dispatch management. Standard F-1220, *Standard Guide for Emergency Medical Services System (EMSS) Telecommunications*, outlines “practices and performance standards required to support all of the functions of community EMSS on a statewide basis...to satisfy the functional needs of comprehensive community EMS systems” (ASTM, 2006, p. 1). The standard lists goals and objectives that should be managed on a statewide basis, with local EMS systems

modifying these guidelines to satisfy their local needs “while providing compatibility and interoperability of communications with other EMS [systems]” (p. 1).

Standard F-1220 states that “EMS dispatch should be prompt” (ASTM, 2006, p. 8), with the requirement that the “delay between the time of first notification of a medical emergency and the receipt of the dispatch message by the responding EMS unit (ambulance or first responder) should never exceed 2 min[utes]” (p. 7). Furthermore, “2 min[utes] is sufficient for an emergency medical dispatcher...to interrogate a caller to determine the nature, severity, and most appropriate resource to dispatch” (p. 8).

The CPSE administers an accreditation process for fire service organizations. Through a self-assessment process and followed by an on-site review, fire service organizations like MCFRS become accredited. Part of the process is the establishment of *performance indicators*, defined as “those activities that the [CPSE] has agreed upon as being appropriate in achieving the goals and objectives of a credible organization and that are quantifiable with a reasonable time frame” (Center for Public Safety Excellence [CPSE], 2006, p. 31). In order to measure performance and achieve objectives, the fire service organization must establish its *baseline* performance. Then, the baseline is compared against a *benchmark*, or a *best practice*, in that performance area that indicates superior performance as achieved by other fire service organizations. This benchmark is the “standard against which the organization must assess itself to determine if its baseline is achieving as acceptable level of performance in the context of industry standards” (p. 31). The CPSE states that for alarm processing performance “a benchmark might be that a fire organization should be able to receive, process, and dispatch apparatus and personnel in 60 seconds” (p. 31).

The CPSE also requires fire service organizations to develop *Standards of Response Coverage*, where levels of fire, rescue and emergency medical services are defined and adequate resources are provided. The agency-specific standards of response coverage is “essential to whether a fire agency is prepared to provide a level of service commensurate with its responsibilities, risks, and adopted service level objectives” (CPSE, 2006, p. 49). *Alarm processing*, as defined by the CPSE, as “the time interval from the point at which a request or alarm is received and transmitted to emergency responders” (p. 70), is an essential component of the response time performance in the standards of response coverage. The CPSE standards of response coverage manual defines *call processing interval* as “the interval between the first ring of the 9-1-1 telephone at the dispatch center and the time the computer-aided dispatch (CAD) operator activates station and/or company alerting devices” (CFAI, 2003, p. 5-2). This interval is can be divided into two specific measurements, the *call taker interval*, which is the “interval from the first ring of the 9-1-1 telephone until the call taker transfers the call to the fire department dispatcher” and the *dispatcher interval*, which is the “interval from the time when the call taker transfers the call to the dispatcher until the dispatcher/CAD operator activates station and/or company alerting devices” (p. 5-2).

The CPSE has established a clear benchmark of 60 seconds for call processing (CPSE, 2006). The alarm processing time interval is a core competency being judged by the CPSE accreditation process. The fire service agency is expected to “meet their staffing, response time, apparatus, and equipment objectives for each type and magnitude of emergency medical deployment objective (p. 85).

Even though the CPSE requires fire service agencies to meet a strict benchmark for call processing, they also advocate the use of structured 9-1-1 caller interrogation to “prioritize

medical incidents based on the type of medical complaint from the patient” (CFAI, 2003, p. 40). They also recommend that EMS response time standards “should be based on the medical urgency of the patient” and that “different response time standards for different risk categories” (p. 40). However, the call processing time recommendation is not adjusted by use of the prioritization of EMS events.

There are three major professional organizations active in the public safety telecommunications industry: the Association of Public-Safety Telecommunications Officials - International (APCO), the National Emergency Numbers Association (NENA), and the National Association of State 9-1-1 Administrators (NASNA). As part of this literature review, these organizations were queried and websites searched for standards on 9-1-1 call processing times. None promulgated any such time standard. Only NENA (2006) had any standards document discussing 9-1-1 call processing, but that dealt directly with the time for the PSAP to answer the 9-1-1 call. This standard requires the the 9-1-1 call be answered by the PSAP within 10 seconds 90% of the time and within 20 seconds 95% of the time.

The Maryland Emergency Number Systems Board (Numbers Board), an agency of the Maryland Public Safety and Correctional Services, oversees the PSAPs in the state. COMAR Title 12 regulates the Numbers Board, and requires that all PSAPs in Maryland have “a sufficient number of call takers and equipment to consistently answer incoming calls on a daily average of 10 seconds or less” (2009a, p. 1), but does not regulate time requirements for 9-1-1 call processing.

A literature search through the National Fire Academy (NFA) Learning Resource Center (LRC) did not reveal any published literature or abstracts on MCFRS call processing times.

There was only one reference to the ECC found; an applied research paper on civilianization of the ECC by Strock in 1996, which did not discuss call processing times.

There have been several reports and documents internal to MCFRS referencing call processing times. One report from the Chief Administrative Officer to the County Council (Romer, 2005) reported that the average 9-1-1 call processing time for EMS events for the year after PS2000 was implemented was 207 seconds (3 minutes 27 seconds). A footnote in the report states that “it is virtually impossible for [ECC] to answer a higher percentage of calls within the one-minute standard” (p. 15), but offered no explanation of this reasoning.

These poor call processing times prompted MCFRS to perform a statistical analysis of call processing times in 2005. The study reported on a small sample of data from November 2005, and noted the extreme difficulty in mining data from the VESTA telephony system and then marrying that to data from the CAD. For ALS events, the analysis reported a 245 second (4 minutes 5 seconds) average 9-1-1 call processing time. A deeper examination of the time intervals show that the PSAP takes an average of 47 seconds of this 9-1-1 call processing time to receive the call and then transfer it to the MCFRS ECC call-taker, leaving an average of 198 seconds (3 minutes 18 seconds) for the MCFRS ECC to process and dispatch the event (Fahimi, 2006). The bulk of this time occurred during the 9-1-1 to pending interval, 140 seconds (2 minutes 20 seconds), was the time at which the MPDS was being used. Once the event is sent to the dispatcher via the CAD, it takes on average 57 seconds to dispatch the event. In this study, there was no analysis provided on how many 9-1-1 calls are handled in under the one minute goal. However, a 90% fractile time was provided at 268 seconds (4 minutes 28 seconds). The study presented no analysis of the cause of the prolonged 9-1-1 call processing times, nor did it make any recommendations for improvement.

The ECC has specific program measures to support its core mission “to ensure rapid and effective emergency assistance to Montgomery County’s citizens” and provide for community risk reduction outcomes to “increase the survival rate for patients requiring Advanced Life Support (ALS) services” (MCFRS, 2006, p. 2). The reported outcome for this program measure was only 5% of the 9-1-1 calls were being processed within the 1-minute goal. For EMS events, the average call processing time was reported to be 194 seconds (3 minutes 14 seconds).

For the initial CountyStat report to the County Executive, several restricting factors were presented. The first was the *9-1-1 Call-Taking, Call-Processing, and Dispatching of Units*. This process takes the ECC an average of 3 minutes, to “obtain vital information from those reporting emergencies, processing that information, and dispatching appropriate units” (Montgomery County Government, 2009b, p. 10). The two other restricting factors presented were *turnout time* and *travel time*. In order to improve this performance area, MCFRS proposed to reduce the time taken to process and dispatch 9-1-1 calls by implanting resource and procedural changes including the addition of more ECC staff, modifying the protocols and procedures, including EMD, and enhancing information technology, including a new CAD and station alerting.

In their text, *Principles of Emergency Medical Dispatch*, Clawson, Dernocoeur and Rose (2008) state that “there is probably no medical profession other than emergency medical dispatching in which the core time for patient evaluation and decision making is routinely around one minute, and where more is potentially at stake on a case-by-case basis” (p. 1.21). They call this concept the *60-Second Dilemma*, to stress that the emergency medical dispatcher has only 60 seconds to interrogate the 9-1-1 caller and make a decision about the EMS response. “Very few, if any, medical professionals are required to consistently perform the evaluation and decision-making part of their patient care process in 60 seconds” (p. 1.21). They admit that “even more

astounding is that there is no scientific rationale for the 60-second time frame for dispatching” (p. 1.21).

Clawson et al. (2008) explain that the purpose of EMD is “positively influence EMS” in the areas of quality of patient care, performance of EMS providers, cost effective allocation of EMS equipment, professionalism of emergency medical dispatchers and the community’s EMS experience (p. 1.21). They state that excellent call processing time is defined as 60 to 90 seconds, and further postulate that “a properly-trained [emergency medical dispatcher] can effectively eliminate this time gap [from 9-1-1 call to first response] for many situations” (p. 1.3). They trademarked the concept of *Zero-Minute Response* as the benefit from emergency medical dispatchers giving pre-arrival medical instructions to the 9-1-1 caller. The primary role of the emergency medical dispatcher is the telephone interrogation of the 9-1-1 caller, the triage of the medical emergency by allocating EMS system resources, and the provision of pre-arrival telephone instructions. Using the theory of zero-minute response, the EMS response time clock can stop prior to the arrival of trained first responders, because the emergency medical dispatcher is the “first, first responder” (Cady, 2001, p. 57).

Clawson et al. (2008) state that “an appropriate response is nearly always better than a maximal response” (p. 1.17). They describe *dispatch life support* as a practice of medicine, and as such, “compliance to the protocol model significantly enhances the [emergency medical dispatcher’s] method of practice by... reducing the time required for evaluation through optimization of interrogation and decision processes” (p. 1.24).

One of the components of a comprehensive EMD program is quality management, the goal of which being “to minimize variance or variation in expected outcomes (response determinant selections) and improve the quality of each activity defined by the [EMD] standard”

(Clawson et al., 2008, p. 12.2). Retrospective quality management for EMD consists of assessing the call takers' compliance levels on individual cases with the EMD protocol, with the goal being 90% to 95% compliance. Clawson et al. explain that this "ability to precisely quantify EMD activity is one of the most powerful features of priority dispatch" (p. 12.7).

The protocol components measured by this process include: primary case entry interrogation, chief complain selection, secondary key question interrogation, determinant code selection, post-dispatch and pre-arrival instruction provisions, and customer service (Clawson et al., 2008). Clawson et al. explain that call processing times are another element of the compliance scoring, but fail to discuss any causal relationship between individual compliance levels and individual call processing time.

A journal paper by Clawson, Cady, and Martin in 1998 hypothesized that "appropriate performance feedback would increase dispatcher compliance with the [EMD] protocol" (p. 578). "Appropriate feedback to emergency medical dispatchers, combined with continuing dispatcher education, would lead to consistently high levels of compliance (defined as "use exactly as written or directed") with dispatch protocol, resulting in coordinately high reliability and consistency in response accuracy" (p. 579). Yet they admit that there is not much validation regarding outcomes related to EMD. Results of their research showed that compliance improved with feedback from a quality assurance program "providing emergency medical dispatchers with regular and objective feedback regarding their performance dramatically improves how rigorously they follow a systematized dispatch protocol" (p. 578), but there was no mention of call processing time changes based on compliance.

Clawson, Martin, Cady, and Sinclair discuss in a 1999 *Fire Chief* article that EMD is designed to provide an urgent response only when medically appropriate for the patient's

condition. Those agencies that do not use EMD typically have a “maximal response philosophy” claiming “to give those in dire need the closest help immediately and ALS as quickly as possible” (p. 46). Clawson et al, believe that this is misguided systems thinking. They use EMD to show that it is “safe, and medically correct, to dispatch less than an ALS paramedic on many EMS incidents” because many requests for EMS are not for “time-critical, life-threatening medical emergencies” (p. 46).

According to Clawson et al. (1999), a “properly implemented and functioning MPDS delivers effective resource utilization, reduces dispatch liability risks, ensures quicker EMS intervention through [dispatch life support] and reduces the workload of other EMS resources” (p. 50). With EMD, the goal is “to send the right thing(s), in the right way, at the right time, in the right configuration, and to do the right things until the troops arrive” (p. 50).

In other words, the goal is to do EMS call processing right, rather than to just do EMS call processing fast. Therefore, 9-1-1 call processing times should have a positive affect on EMS response times, when it is medically appropriate to process the call quickly and send a maximal ALS response.

Several applied research projects at the LRC dealt with 9-1-1 call processing times. In 1995, Geare examined two areas of deficiency for the Tucson Fire Department prior to implementation of an EMD program; the ability of the 9-1-1 center to dispatch the most appropriate unit and the ability to provide pre-arrival instructions to 9-1-1 callers. Geare did not evaluate compliance levels with their new EMD protocols, but nonetheless found that call processing times for BLS events increased by 138% (from 41 to 98 seconds) and ALS events increased by 159% (from 38 to 98 seconds). Geare theorized that the quality assurance process itself was a contributor to the longer dispatch times “due to concern on the dispatchers’ part to be

exact in both the sequence of the questions and the verbiage” (p. 22). “Resistance to change may account for the increase in mean dispatch time as some dispatchers are reluctant to change long-standing work behaviors” (p. 22).

Another older applied research project by Scofield in 1995 examined the quality assurance plan in the context of risk management for emergency communications center utilizing EMD. Scofield concludes that the “greatest liability risk exposure in EMD programs is in the accurate prioritization of incoming EMS calls” (pp. 18-19). While not directly examining the causal relationship between compliance scores and call processing times, he does state that “adherence to these elements will not only protect against unnecessary litigation, but it will assure that those people in need of EMS service will receive prompt efficient help in their time of need” (pp. 18-19).

Pendleton (1999) published in his applied research project that MPDS “tends to increase the amount of alarm processing time (p. 17). His review of statistics from the Rural/Metro Fire Department Communications Center shows that their 9-1-1 call processing times range from 60 seconds to process a Delta-level call to 90 seconds to process an Alpha-level call. He discloses that “if MPDS were to be eliminated, it would reduce the amount of time to process a large percentage of calls having a detrimental effect on Rural/Metro Pima County overall response time statistics” (p. 18).

The purpose of the research by Bailey, O’Connor and Ross (2000) was “to determine whether implementation of an EMD system would reduce the rate of inappropriate ALS utilization and enable more accurate identification of those patients requiring ALS care” (p. 186). However they did not examine the role of call processing times. Nonetheless, they discovered

that the use of EMD resulted in a significant decrease in the number of inappropriate ALS dispatches, with an EMD compliance rate of more than 95%.

Murray (2000) recommends a two-step dispatching approach to speed up the call processing time. First is the rapid (i.e., within 30 seconds) activation of the closest resource to any emergency. He states that “if you wait to get a[n EMD] dispatch determinant, you will be too late to make a difference in life-threatening circumstances” (p. 30). This would be followed, in tiered response EMS systems, by the “nearest appropriately qualified” unit (p. 30). He also recommends that response crews receive dispatch information in two phases. First, dispatchers should give a pre-alert which contains address and directional information so that the appropriate units can begin response, prior to following the EMD protocol. This is followed by a second dispatch which would contain further directional information and patient details after EMD has been completed. Thus, priorities for call takers would be to establish the location of the event, pass this on to the dispatcher and then follow the EMD protocol to obtain more patient details to pass on to the dispatcher.

Cady, in a 2001 *9-1-1 Magazine* article stated that EMD “enables EMS systems to initiate supportive care before the first responder arrival with EMD-directed bystander interventions” (p. 57) thus negating the need for a more rapid response by field units. With the use EMD protocols, EMS systems can “improve operational efficiencies through changes in response time performance requirements” and “improve patient outcomes through more effective and efficient use of resources for bona fide emergencies” (p. 57).

More recently, Olson’s applied research project in 2003 showed that “dispatches using EMD protocols took nearly twice as long as fire-related incidents” (p. 24). His results revealed that it takes an average of 183 seconds to process a call using EMD. He surmised that “extended

alarm processing times were likely the result of the Case Entry protocol” (p. 24), yet did not review compliance levels with the protocol itself. He recommends that “procedures [be] modified to allow dispatchers to notify emergency personnel as soon as the location, nature of the injury or the complaint, and the severity of the injury were determined” (p. 24) in order to speed up the call processing times to meet standards. Olson also discovered that quality assurance was performed by 65% of reporting centers from Illinois, yet did not reveal any causal relationship between compliance and call processing times.

In his applied research project, Wilcox (2007) examined EMD as a time consuming process, where “inappropriate level[s] of response could occur if the process is not followed” (p. 20). While again there was not assessment of EMD compliance levels, he did conclude that it was “visibly evident that there is at least 60 seconds of time to be saved in the initial questioning and the nature code assignment process” (p. 20). Wilcox also found that prolonged call processing times when using EMD have affected the total EMS response times in Aurora, Colorado. From observing call processing at his communications center, Wilcox discovered that when the request for service is EMS, the call processing time increases because of the EMD process. The Aurora Fire Department had been meeting its response time goals of 8 minutes as high as 88% of the time. Wilcox concluded that if 40 seconds could be saved off of call processing; the EMS response time goals could be met.

Once again, a literature search was conducted at the NFA LRC to discover past research on 9-1-1 call processing times for other jurisdictions in the Washington, DC, National Capital Region. Only one reference was found; an applied research project by Bowman in 2002 from Prince William County, Virginia. The purpose of his research was “to determine if the 60-second dispatch goal for Priority 1 and 2 incidents is relevant and obtainable when using an emergency

medical dispatch protocol” (p. 2). Prince William County Fire and Rescue was experiencing problems similar to Montgomery County, in that it was failing to meet their established 9-1-1 call processing times. Their established goal was 60-seconds 35% fractile, measured on weekly basis. Bowman presented results in a range, showing that they only met the 60-seconds goal between 21% and 41 % of the time for priority 1 events, and between 6% and 31% of the time for priority 2 events. The reported average total call processing times for priority 1 events ranged from 74 seconds to 127 seconds. Bowman concluded that “priority 1 calls are processed somewhat faster when compared to all calls” (p.44) and that “the 60-second time interval should be used as a goal or objective to strive for in most situations – not a rule or absolute number” (p. 51). “A more reasonable goal is 75 to 90 seconds for most calls” (p. 51).

Bowman’s (2002) research on call processing showed that EMD takes one of two pathways when used properly. The first allows for immediate recognition of time-critical medical emergency situations. The second is used when there are not time-critical medical emergencies, in which priorities are objectively sorted prior to dispatch. When Bowman analyzed the priority of incidents as recommended by MPDS as being true emergencies against those that were true emergencies, dramatic improvement in response were shown.

Much of the literature regarding call processing times is not current. However, research by Geare (1995), Pendleton (1999), Olson (2003), Bowman (2002), and Wilcox (2007) all point to the fact that the use of EMD by public safety 9-1-1 call centers does increase the 9-1-1 call processing times. This certainly influenced this applied research project in that it shows that there are other agencies with similar documented problems as MCFRS. Yet no viable solutions have been presented by these researchers.

The literature presented by Clawson, Cady, Martin and Sinclair (1998), and by Clawson, Dernocoeur and Rose (2008) point to the appropriate use of EMD as a tool to provide quicker medical care to patients via two pathways. The first pathway, when the caller identifies a time-critical, life-threatening emergency, EMD can be utilized quickly to dispatch the closest and appropriate resources, and then allow the call-taker to go back to the caller and provide appropriate life-support instructions to begin patient treatment before the arrival of responders. The second pathway, when the caller identifies a non time-critical, non-life threatening emergency, EMD is used to prioritize the call and send the appropriate resources. By prioritizing the call, by design more questions are asked of the caller and the more time it takes to process; and after being sent to the dispatcher, these lower priority calls might be held for other higher priority calls to be dispatched first, thus taking more time. This influenced the research to discover if MCFRS is utilizing EMD appropriately, as designed, even when it takes longer than standards to process a 9-1-1 telephone call.

If EMD is designed to be fast when time is critical, then the standards we used as benchmarks should reflect that. From the literature review, it was discovered that the NFPA standards, while not recognizing EMD as part of the process, does recognize that its standards only apply only to emergency incident response and the jurisdiction defines the data sets to be included in the reporting of response times. This influenced this research to look only at the 9-1-1 call processing and response times of the truly time-critical EMS events and base any recommendations on these events alone.

Procedures

For the first research question about the applicable standards and regulations on 9-1-1 call processing times for emergency medical services, the documents obtained from the literature

review were searched for relevant data. For the literature review, a keyword search using *call processing time* was first conducted at the LRC to discover the standards. Next, fire and emergency medical services references were searched for applicable standards, including the NFPA, the ASTM and the CPSE. Then, a search of telecommunications industry-specific website such as APCO, NENA and NASNA was conducted. Follow-up email inquiries to those sources were made asking about applicable standards. Finally, a keyword search using *call processing time* was conducted on-line for 9-1-1 call processing regulations in Maryland and Montgomery County. All information discovered was collectively reviewed and presented in the results section.

For the second research question about the current 9-1-1 call processing times for emergency medical services in Montgomery County, data were gathered and examined using three separate methods. First, the 9-1-1 call processing time data were measured and presented as described in the 2005 *Master Plan*. Daily response time performance reports were collected from January 1, 2009, through June 30, 2009. The daily average call processing times for ALS events were transcribed from each report into an Excel spreadsheet, and then analyzed using the *table* and *chart* functions. Since the *Master Plan* calls for measuring the data in averages (i.e., mean), and not with fractile times, the data were analyzed using the same method. The data from these daily response time performance reports include all dispatched ALS events at the MPDS Charlie, Delta and Echo levels. The daily response time performance reports do not separate the non-time-critical Charlie ALS events from the time-critical Delta and Echo ALS events.

Second, the 9-1-1 call processing time data were measured and presented as described by NFPA 1221. Raw data on call processing time for ALS events were collected from the Records Management System (RMS) via a Crystal Reports interface. Since the NFPA standards state that

the ALS response times should only be measured for emergency incidents, the data were filtered and only MPDS Delta and Echo level ALS events (i.e., those that are time-critical, life-threatening emergencies) were used. The data were also filtered so that only MPDS Echo level ALS events were used in order to provide a comparison point for the data. All of the data were separated by month from January 1, 2009, through June 30, 2009. The monthly call processing times for ALS events were exported into an Excel spreadsheet, and then analyzed using the *table* and *chart* functions. Since NFPA 1221 calls for measuring the data at 90% fractile times, these data were analyzed and presented using the same method.

This same dataset was used to determine average (mean) 9-1-1 call processing times using a 50% fractile measurement. This was done in order to assess the validity of this dataset with the data produced from the daily response time performance reports.

One notable limitation to this dataset was discovered during the analysis. For 13.4% of the events in the dataset, the phone-to-pending interval was missing (i.e., a null value). This prompted an investigation. According to the MCFRS data warehouse manager, this is a known issue between the VESTA 9-1-1 telephone interface and the CAD system. Historically, up to 40% of this data have been missing, due to a problem transferring automatic number information and automatic location information (ANI-ALI) data from VESTA into CAD. When the ANI/ALI data does not transfer into the CAD, there is no start time logged for the phone-to-pending interval. Therefore, the first timestamp is when the event is sent to the dispatcher as a pending event. When the phone-to-pending interval is a null value, the entire event is deleted from the daily response time reports. Thus, the accuracy of the daily response time reports is also questionable.

Third, the 9-1-1 call processing time data were measured and presented as described by ASTM F-1220. The same raw data on 9-1-1 call processing time for ALS events were used from the NFPA 1221 analysis. The data were separated by month from January 1, 2009, through June 30, 2009. The monthly call processing times for ALS events were exported into an Excel spreadsheet, and then analyzed using the *table* and *chart* functions. Since the ASTM calls for measuring the data at 120 seconds maximum, these data were analyzed and presented as a percentage of the events met the standard.

For the third research question on how call-taker compliance levels with the MPDS protocols effect 9-1-1 call processing times, actual compliance scores were compared to the phone-to-pending interval of the call processing times. Random EMD compliance scores for the first half of 2009 were obtained from the ECC Quality Assurance Officer. The overall compliance scores comprise an average of the following scores: case entry, chief complaint, key questions, pre-arrival instructions, post-dispatch instructions, final coding and customer service. These scores were associated to their phone-to-pending intervals from the raw ALS call processing data. The results were graphed on an xy (scatter) chart to show the relationship, or correlation, between EMD compliance scores and call processing time.

Once the data was plotted, the correlation coefficient was calculated using the following formula: $\text{correlation } (r) = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{[N\sum X^2 - (\sum X)^2][N\sum Y^2 - (\sum Y)^2]}}$. If the resulting correlation (r) is a positive number close to 1, then there will be a positive correlation between EMD compliance and 9-1-1 call processing times. If the correlation (r) is a negative number close to -1 , then there will be a negative correlation between EMD compliance and 9-1-1 call processing times.

The limitation for this methodology was a very small sample size of EMD scores. The entire population of EMD scores for the first half of 2009 totaled 64. However, out of the population, only 13 EMD scores were for events at the MPDS Delta or Echo ALS level. This produced a small sample size. Therefore, the entire population of the EMD scores was also graphed on an xy chart for comparison.

Another limitation of this methodology is the use of the actual 9-1-1 call processing times. 9-1-1 call processing times are made up of two separate intervals (i.e., phone-to-pending and pending-to-dispatch). Since these are two separate functions at the ECC, and only the phone-to-pending interval is directly related to use of EMD, the data were also presented comparing EMD scores to just the phone-to-pending intervals.

For the fourth research question on how 9-1-1 call processing times affect overall emergency medical services response times, the same raw data on 9-1-1 call processing time for ALS events were used from the NFPA 1221 analysis. An Excel spreadsheet was used to perform mathematical calculations on the data. First, total response times for these ALS events (i.e., receipt of 9-1-1 call to ALS transport unit arrival on the scene) were calculated and then compared to the NFPA 1710 standard. The NFPA 1710 standard requires a total ALS response time of less than 600 seconds (60 seconds call processing + 60 seconds turnout time + 480 seconds ALS unit response time). Next, the difference between the actual call processing times and the NFPA standard was determined for each event. Then, the time difference was subtracted from the overall ALS response time to determine the effect of substandard call processing times. The resulting times, if now under the total ALS response time standard of 600 seconds, represent the events that could have met the NFPA's ALS response time requirements if the ECC were processing ALS events within the standard.

For the last research question, on how the 9-1-1 call processing times in Montgomery County compare to those of other jurisdictions in the National Capital Region, a simple questionnaire was presented to the Communication Center Managers of the Metropolitan Washington Council of Governments – National Capital Region (MWCOG-NCR) member jurisdictions, which include the District of Columbia; Frederick, Montgomery, and Prince George’s Counties in Maryland; Loudoun, Fairfax, Prince William and Arlington Counties in Virginia; and the cities of Alexandria, Manassass and Falls Church in Virginia. The questionnaire was developed using the web-based survey tool called *SurveyMonkey*, and a web link for the questionnaire was distributed via email to the MWCOG-NCR Communications Subcommittee members. The web link for the questionnaire remained active for a period of six weeks. Follow up emails were sent to member jurisdictions that did not respond to the initial request. The data from the questionnaire was downloaded from the *SurveyMonkey* website directly into an Excel spreadsheet. The *table* and *chart* functions of Excel were used to graphically present the data for analysis.

The specific questions were designed to solicited information from public safety communications centers in the National Capital Region on their 9-1-1 call processing times (see Appendix A). Specifically, information was requested on their measurement of overall 9-1-1 call processing times, measurement of EMD processing time and variables such as type of CAD, type of EMD product and compliance with NFPA standards.

Limitations for this questionnaire include a very small sample size, along with the uncertain willingness of potential respondents to complete the questionnaire. Out of the nine major jurisdictions that make up the National Capital Region, excluding Montgomery County,

seven responded. But only three of the responding jurisdictions reported that they measure their 9-1-1 call processing and EMD processing times.

Results

What are the applicable standards and regulations on 9-1-1 call processing times for emergency medical services? The only sources with documented 9-1-1 call processing time standards were the NFPA, CPSE and the ASTM. NFPA Standard 1221, as reaffirmed in NFPA Standard 1710, requires 9-1-1 call processing times of 60 seconds or less 90% of the time. The NFPA requirements only apply to emergency incident response. NFPA 1221 allows certain types of 9-1-1 calls to be excluded from the above time requirements. The exempted 9-1-1 calls include those requiring a language line translator or telecommunications devices for the deaf (TTY/TDD) and other jurisdiction-defined exclusions known to take extra caller interrogation. These NFPA call processing requirements are part of a continuum of response time requirements from the NFPA as presented in Table 1.

The CPSE recommends that fire service agencies to meet a strict benchmark of 60 seconds for call processing on EMS events based on the medical urgency of the patient. This recommendation is derived from the NFPA standards and is presented as a best practice for fire service agencies to benchmark their own performance against. While the CPSE urges jurisdictions to set their own performance standards, the *Standards of Response Coverage* document used for developing resource deployment makes the 60-second call processing time a standard.

Table 1

NFPA Alarm Handling Requirements (NFPA, 2009a and NFPA, 2009b)

<i>Time Interval</i>	<i>Responsible Agency</i>	<i>Standard</i>	<i>1st Performance Level</i>	<i>2nd Performance Level</i>
PSAP Alarm Answering Time	PSAP	NFPA 1221	15 seconds 95%	40 seconds 99%
Alarm Transfer Time	PSAP	NFPA 1221	30 seconds 95%	None
Alarm Answering Time	FD	NFPA 1221	15 seconds 95%	40 seconds 99%
Alarm Processing Time	FD	NFPA 1221	60 seconds 90%	90 seconds 99%
Turnout Time	FD	NFPA 1710	60 seconds 90%	None
First Responder Travel Time	FD	NFPA 1710	240 seconds 90%	None
ALS Travel Time	FD	NFPA 1710	480 seconds 90%	None
Initiate Action/Intervention Time	FD	NFPA 1710	Not Yet Developed	Not Yet Developed

The ASTM develops standards specifically for EMS systems and recognizes that EMD is part of the process of call-taking EMS events, and therefore includes time to perform EMD in the standard. ASTM Standard F-1220 requires that 9-1-1 call processing times for EMS events should not exceed 120 seconds. This is not an average or fractile measurement; rather it is set as a maximum allotted time for system-wide call processing.

The only regulation that has authority over MCFRS with a 9-1-1 call processing time requirement is the 2005 MCFRS *Master Plan*. The *Master Plan*, signed into law as an Executive Regulation, requires the ECC to process requests for emergency services within 60 seconds, despite the various overall response time requirements presented. Table 2 compares the requirements of standards from the NFPA, ASTM and CPSE with the regulation from Montgomery County.

Table 2

9-1-1 Call Processing Time Requirements for EMS Events

<i>Standard</i>	<i>EMS Call Processing Time</i>
NFPA	60 seconds 90% of the time
CPSE	60 seconds
ASTM	120 seconds maximum
MCFRS	60 seconds

What are the current 9-1-1 call processing times for emergency medical services in Montgomery County? As measured against the MCFRS Master Plan requirements, the current average (mean) 9-1-1 call processing time for EMS events in Montgomery County is *169 seconds (2 minutes 49 seconds)*, as displayed over a six month period in Table 3. This result is derived from the daily response time reports, and includes all ALS events at the Charlie, Delta and Echo levels. The 169 seconds result is almost three times the requirement (60 seconds). As a first comparison, only MPDS Delta and Echo level ALS events were used to calculate average 9-1-1 call processing times. This resulted in an average of *140 seconds*, as displayed over a six month period in Table 4. As a second comparison, only the MPDS Echo level ALS events were used to calculate the average 9-1-1 call processing times for the truly time-critical, life-threatening events. This resulted in an average of *132 seconds*, as displayed over a six month period in Table 5. It would seem the higher priority MDPS level events can be processed quicker.

Table 3

Average MCFRS ALS Call Processing Times - Master Plan Requirements

	<i>Average Call Processing Time (seconds)</i>
January 2009	164
February 2009	162
March 2009	169
April 2009	171
May 2009	176
June 2009	170
Average	169

Table 4

Average MCFRS ALS Call Processing Times –Delta and Echo Events

	<i>Average Call Processing Time (seconds)</i>
January 2009	140
February 2009	140
March 2009	143
April 2009	146
May 2009	148
June 2009	141
Average	140

Table 5

Average MCFRS ALS Call Processing Times – Echo Events

	<i>Average Call Processing Time (seconds)</i>
January 2009	118
February 2009	143
March 2009	143
April 2009	135
May 2009	122
June 2009	129
Average	132

As measured using the fractile response time standards from NFPA 1221, the current 9-1-1 call processing times in Montgomery County is *230 seconds* (3 minutes 50 seconds) for 90% of the events for ALS events (MPDS Delta and Echo levels). The 9-1-1 call processing times measured were consistent at 230 seconds for each month as displayed in Table 6. The percentage of call processing times that were successfully completed in less than 60 seconds was 1% in January, April and May of 2009, and 0% in February, March and June of 2009 as presented in Table 6.

Table 6

Fractile MCFRS ALS Call Processing Times - Delta and Echo Events

	<i>Call Processing Time 90% Fractile (seconds)</i>	<i>% Call Processing Times < 60 s</i>
January 2009	230	1
February 2009	230	0
March 2009	230	0
April 2009	230	1
May 2009	230	1
June 2009	230	0
Average	230	0.5

Since the call processing times were consistent across all six months, only the data from January 2009 are presented to illustrate the individual time intervals in a tabular form as seen in Table 7, as well as graphically as seen in Figure 1.

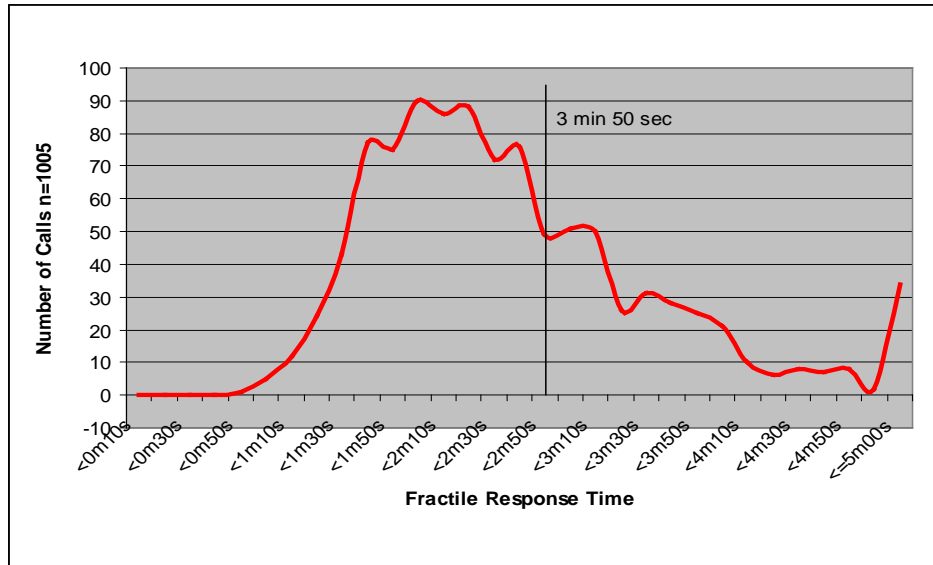
Table 7

Call Processing Fractile Times – January 2009

Call Processing	January 2009		
	# of Calls	%	Cumulative %
<0m10s	0	0%	0%
<0m20s	0	0%	0%
<0m30s	0	0%	0%
<0m40s	0	0%	0%
<0m50s	1	0%	0%
<1m00s	5	0%	1%
<1m10s	12	1%	2%
<1m20s	24	2%	4%
<1m30s	43	4%	8%
<1m40s	77	8%	16%
<1m50s	75	7%	24%
<2m00s	90	9%	33%
<2m10s	86	9%	41%
<2m20s	88	9%	50%
<2m30s	72	7%	57%
<2m40s	76	8%	65%
<2m50s	49	5%	69%
<3m00s	51	5%	75%
<3m10s	50	5%	80%
<3m20s	26	3%	82%
<3m30s	31	3%	85%
<3m40s	28	3%	88%
<3m50s	25	2%	90%
<4m00s	21	2%	93%
<4m10s	10	1%	94%
<4m20s	6	1%	94%
<4m30s	8	1%	95%
<4m40s	7	1%	96%
<4m50s	8	1%	96%
<5m00s	2	0%	97%
<=5m00s	34	3%	100%
Total	1005		

Figure 1

Call Processing Time Graph (Delta and Echo Events) – January 2009



As a comparison, the 90% fractile 9-1-1 call processing times for ALS events at the MPDS Echo level only was determined to be *183 seconds* (3 minutes 3 seconds), as depicted over six months in Table 8. The percentage of call processing times that were successfully completed in less than 60 seconds was an average of 2.3% (see Table 8). As a graphical example, the data from January are presented to exemplify the individual time intervals in Figure 2. These calculations show that Echo events can be processed faster (by 47 seconds) than the combination of Delta and Echo events.

The raw data used to determine this fractile response time can be broken down further into two interval periods, one from the receipt of 9-1-1 call to pending in the dispatch queue, and then from pending to actual dispatch (see Table 9). The call-to-pending interval ranges from 155 to 166 seconds (average of 160 seconds), and the pending-to-dispatch interval ranges from 64 to 75 seconds (average of 70 seconds). At the ECC, these two intervals are considered separate functions, and the longer call-to-pending intervals include the MPDS function.

Table 8

Fractile 9-1-1 ALS Processing Times - Echo Events

	<i>Call Processing Time 90% Fractile (seconds)</i>	<i>% Call Processing Times < 60 s</i>
January 2009	176	3
February 2009	198	3
March 2009	157	2
April 2009	200	3
May 2009	170	3
June 2009	197	0
Average	183	2.3

Figure 2

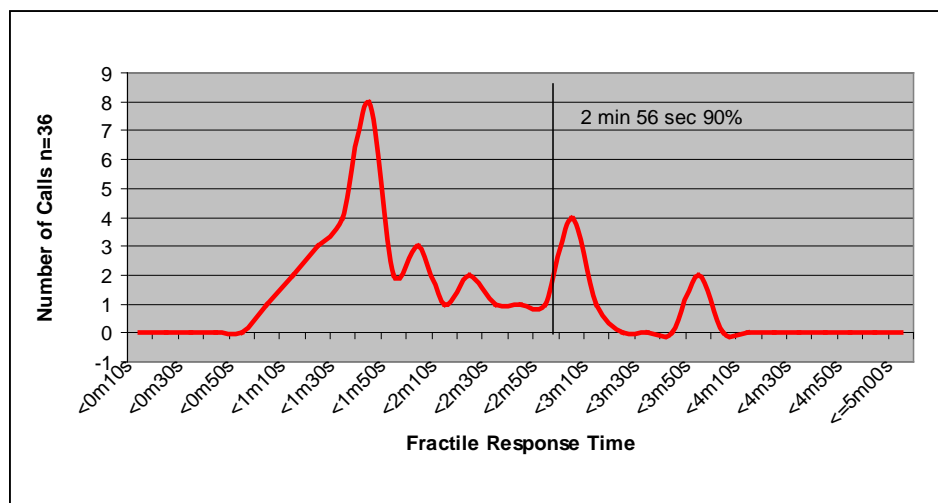
Call Processing Time Graph (Echo Events) – January 2009

Table 9

Call Processing Fractile Time Intervals - Delta and Echo Events

	<i>Call to Pending Interval (seconds)</i>	<i>Pending to Dispatch Interval (seconds)</i>	<i>Call Processing Time (seconds)</i>
January 2009	160	70	230
February 2009	155	75	230
March 2009	155	75	230
April 2009	166	64	230
May 2009	165	65	230
June 2009	160	70	230
Average	160	70	230

MCFRS meets the ASTM call processing time requirement of 120 seconds for EMS events on average 33% of the time (see Table 10). This calculation was based on the same raw data used for the NFPA calculations.

Table 10

MCFRS ALS Call Processing Times ASTM F-1220 Standards – (Delta and Echo Events)

	<i>Call Processing Time 90% Fractile (seconds)</i>	<i>Percentage of Call Processing Times < 120 seconds</i>
January 2009	176	33
February 2009	198	31
March 2009	157	30
April 2009	200	36
May 2009	170	35
June 2009	197	32
Average	183	33

How do call-taker compliance levels with the MPDS protocols affect 9-1-1 call processing times? Figure 3 represents the EMD scores for ALS events plotted against 9-1-1 call processing times for the first half of 2009 in Montgomery County. The calculated correlation

coefficient (r) is -0.06492 . This negative number is close to zero, so there is no correlation between EMD scores for ALS events and 9-1-1 call processing times. Figure 4 represents the EMD scores for all EMS events (all MPDS levels, BLS and ALS) plotted against 9-1-1 call processing times. The calculated correlation coefficient (r) is 0.09928 . This number is also close to zero, so there is no correlation between EMD scores for EMS events and 9-1-1 call processing times. Figure 5 represents the EMD scores for all EMS events (all MPDS levels, BLS and ALS) plotted against the phone-to-pending interval of the 9-1-1 call processing times for those events. The calculated correlation coefficient (r) is 0.068 . This number is close to zero, so there is no correlation between EMD scores for EMS events and phone-to-pending time interval.

Figure 3

EMD Scores for ALS Events versus 9-1-1 Call Processing Times – No Correlation

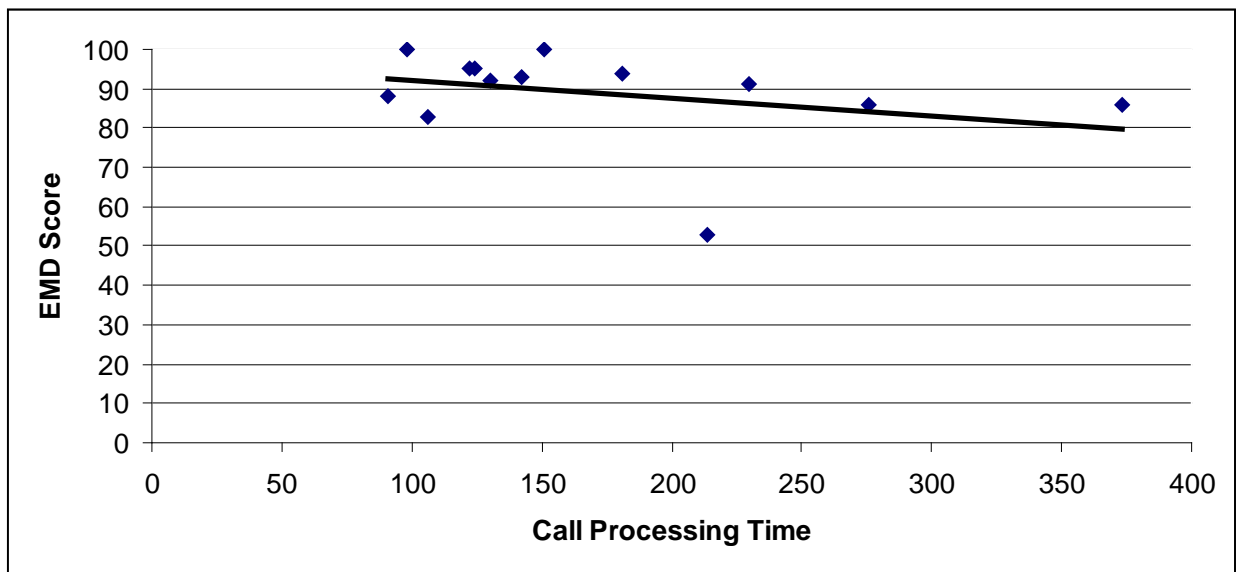


Figure 4

EMD Scores for ALS and BLS Events versus 9-1-1 Call Processing Times – No Correlation

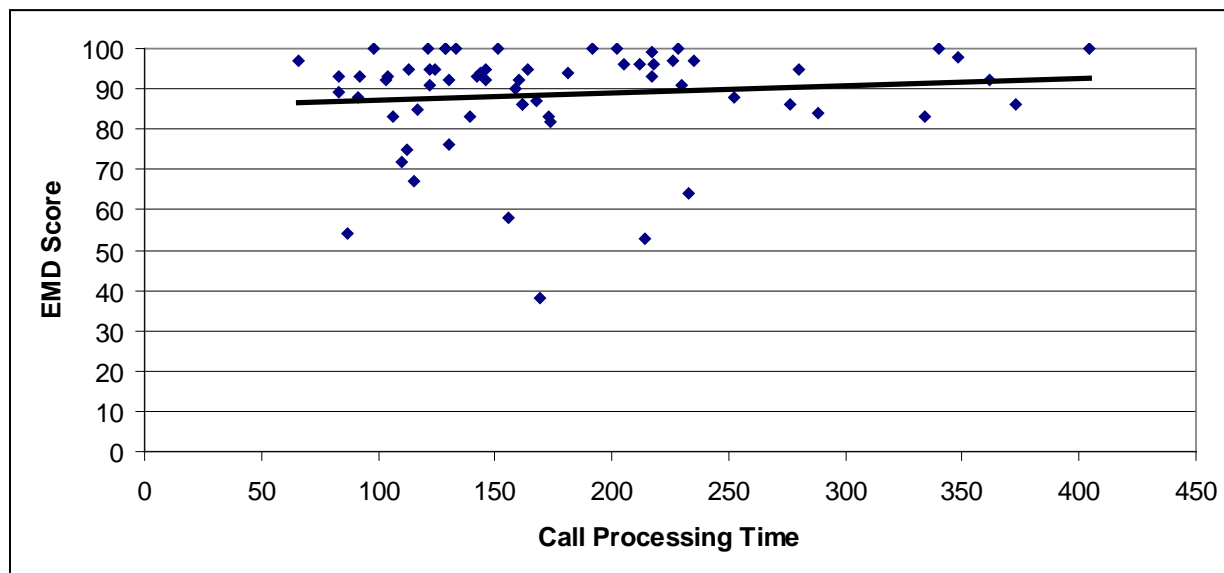
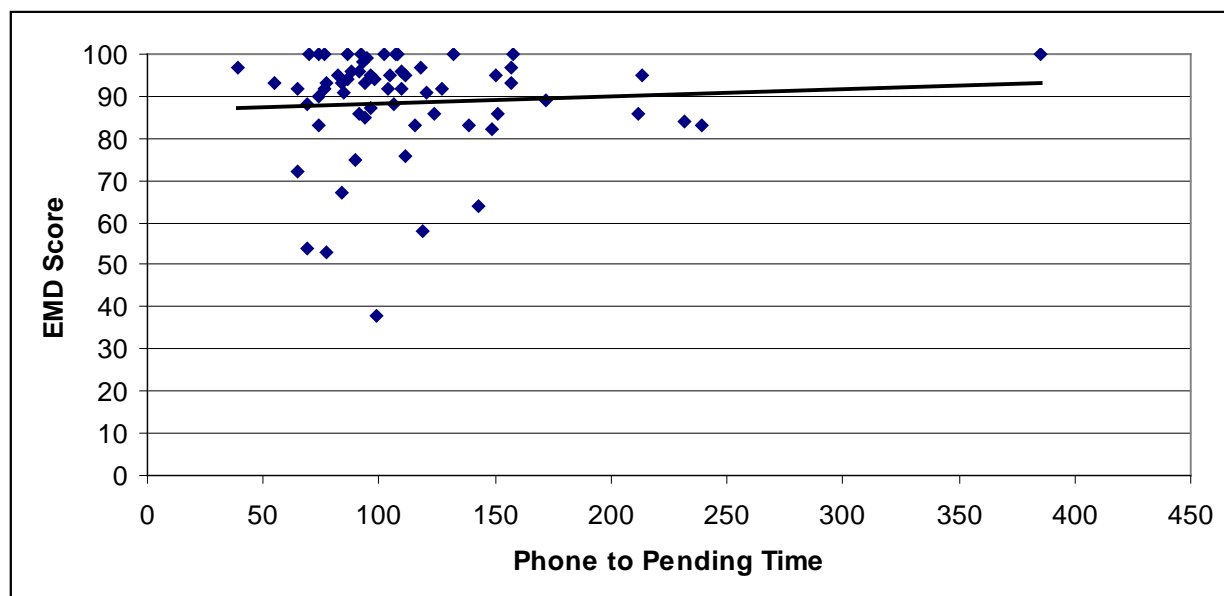


Figure 5

EMD Scores for ALS and BLS Events versus Phone-to-Pending Times – No Correlation



How do the 9-1-1 call processing times affect the overall emergency medical services response times? Analysis of the raw data on ALS response times from January to June 2009

reveals that 64% of the time, MCFRS meets the NFPA standards for total ALS response times (9-1-1 call to ALS unit arrival on scene). For the remaining number of events, slightly over one third could have met the NFPA standards for total ALS response time had the 9-1-1 call processing times been less than 60 seconds, per the NFPA standard. This equates to a total of 14% of all ALS events had total response times that failed to meet the NFPA standards because, in part, of the failure of the ECC to meet 9-1-1 call processing time standards.

As a means for comparison, the data were evaluated against the 8-minute ALS response time standard as published in the *Master Plan*. The results show that MCFRS meets the *Master Plan* standard only 36% of the time. For the remaining number of events, approximately half could have met the *Master Plan* standards had 9-1-1 call processing times been less than 60 seconds.

How do the 9-1-1 call processing times in Montgomery County compare to those of other jurisdictions in the National Capital Region? For those jurisdictions in the National Capital Region that reported call processing times, the times ranged from 60 to 95 seconds (see Table 9). Several of the reporting jurisdictions report high degrees of success meeting their call processing goals as shown in the last column of Table 11. All of the respondents use civilian call-takers, while Montgomery County still uses uniformed personnel as call-takers and dispatchers. All respondents use some form of EMD, but 5 out of 7 use the manual cards, not software interfaced with their CAD systems.

Table 11

Call Processing Times – National Capital Region

Respondent	Call Processing Time (seconds)	Percentage of Total Events Meeting Call Processing Goals
1	N/A	95
2	90	N/A
3	N/A	N/A
4	95	53
5	N/A	75
6	N/A	N/A
7	60	35

Discussion

In the foreword to the textbook *Principles of Emergency Medical Dispatch*, the late James Page is quoted as questioning why EMD has become “the last major change or improvement in the structure of prehospital emergency medical care” (Clawson, Dernocoeur & Rose, 2001, p. ix). “In many cities and communities, there is a gap in the typical emergency medical dispatch and response procedure” (p. ix). Clearly, that gap exists in Montgomery County as indicated by the high 9-1-1 call processing times for emergency medical services.

The literature review and study has shown that there is not a consistent method for either defining or measuring 9-1-1 call processing time. The NFPA uses the term *alarm processing* instead of *call processing*, a throwback to the era of fire alarm boxes, which indicates a lack of appreciation of the significant role of emergency medical services in the modern fire service. This alarm processing is defined as “the time interval from when the alarm is acknowledged at the communications center until response information begins to be transmitted...to emergency response units” (NFPA, 2009b, p.7). The NFPA requires that alarm processing be completed within 60 seconds for 90% of the events. NFPA 1710 further requires that alarm processing be evaluated on a monthly basis and then only on “emergency incident data” and “emergency

incident response” (p.7). For MCFRS, the interpretation should mean that the standard only applies to structure fires and EMS events at the MPDS Delta and Echo levels, which require lights and sirens (i.e., hot) response. However, this standard does not consider the communications center’s use of an EMD product, which in itself can take 60 seconds to accurately prioritize the event. The implications for MCFRS are that it needs to either eliminate or bypass the use of EMD, which would violate state laws, in order to meet the NFPA standards or denounce the NFPA standard in favor of another standard such as the ASTM for EMS call processing.

The ASTM (2006) takes a different approach to 9-1-1 call processing than the NFPA. The ASTM telecommunications standards are created specifically for Emergency Medical Services Systems and are designed to give performance standards to both on a statewide basis and community levels. The ASTM recognizes that EMD is an integral function of the 9-1-1 call taking process for EMS events, and considers the length of time to prioritize a medical 9-1-1 call in its standard. ASTM F-1220 sets a standard of 120 seconds for 9-1-1 call processing of an EMS event by stating “2 min[utes] is sufficient for an emergency medical dispatcher...to interrogate a caller to determine the nature, severity, and most appropriate resource to dispatch” (p. 8). Since MCFRS cannot legally stop using EMD, then MCFRS should use the most appropriate standard (ASTM F-1220) as a benchmark for 9-1-1 call processing of EMS events.

The CPSE (2006) allows fire departments going through the accreditation process to set their own performance indicators and benchmarks. It suggests in one document that “a benchmark *might be* [emphasis added]... able to receive, process, and dispatch apparatus and personnel in 60 seconds” (p. 31). Yet in another document, the standards of response coverage establish a *requirement* for call processing to be under 60 seconds. Even though the requirement

is set at 60 seconds, the CPSE still advocates the use of structured 9-1-1 caller interrogation to “prioritize medical incidents based on the type of medical complaint from the patient” (p. 40) and additionally recommends that EMS response time standards be based on the medical urgency of the patient” (p. 40). The implication for MCFRS is that call processing for only the most critical, time-dependent medical emergencies should be set as a performance indicator.

It is interesting that the public safety telecommunications industry does not advocate any type of 9-1-1 call processing standards. Agencies such as APCO, NENA and NASNA are more concerned with standards for the PSAP to answer the 9-1-1 call. The implication for MCFRS is that efforts should be placed on establishing adequate levels of call-taker staffing, rather than forcing inadequate staffing to perform faster.

MCFRS currently defines overall response times in several different ways. But for *Master Plan* and *Strategic Plan* reporting, CPSE accreditation and CountyStat reporting, the 9-1-1 call processing remains at a consistent 60 seconds. Only recently has MCFRS begun to benchmark 9-1-1 call processing times against the NFPA standards and is continuing to refine its reporting process.

The results of this research show different results for 9-1-1 call processing times. What is reported to senior staff on a daily basis is an average 9-1-1 call processing time for all ALS events (Charlie, Delta and Echo levels). As reported in the results section, the *average* 9-1-1 call processing time for ALS events for the first half of 2009 is 169 seconds. Keeping in mind that the MPDS software is designed to process Echo level events quicker than lower level determinants, a comparison of the data shows that the *average* 9-1-1 call processing time for Delta and Echo is 140 seconds, and for just Echo events the *average* is 132 seconds. The interpretation of these results is that EMD is working as designed, as it allows MCFRS call-

takers to process the life-threatening, time-critical Echo events 37 seconds faster, on average, than all of the MPDS ALS levels combined.

When the 9-1-1 call processing data was examined using NFPA 90% fractile requirements, the results show that for Delta and Echo events combined the call processing time is 230 seconds, while for Echo events alone the call processing time is 183 seconds. Again, the interpretation is that EMD is working properly, allowing Echo level events to be processed 47 seconds faster. What is startling about the data is that MCFRS still processes Echo level events three times slower than NFPA standards allow (183 seconds v. 60 seconds). Interpreting the data, MCFRS only meets NFPA response time standards less than 3% of the time for Echo events and less than 1% of the time for all ALS events combined. The results of this study also indicate that the phone-to-pending interval takes up two-thirds (average of 160 seconds) of the of the overall 9-1-1 call processing time, while the pending-to-dispatch interval takes up the remaining one-third (average of 70 seconds). The implication for MCFRS is that EMD is working faster for the more life-threatening, time-critical events; and MCFRS needs to determine what other pieces of the workflow process are causing the slowness of the call processing function.

When the 9-1-1 call processing data was examined against ASTM requirements, MCFRS was able to meet the standard of 120 seconds 33% of the time. These results again confirm that EMD is working as originally designed; to provide an urgent response only when medically appropriate for the patient's condition. The implication, based on both the NFPA and ASTM comparisons, is that MCFRS still fails to meet national 9-1-1 call processing standards.

As documented in the literature review, 9-1-1 call processing times for MCFRS have been consistently high since the inception of PS2000. All previously reported ALS call processing times have been an average of over 3 minutes in duration, ranging from 180 seconds

to 207 seconds. The results of this study show that the current average 9-1-1 call processing times for ALS events (Charlie, Delta and Echo level) is 169 seconds. This has been a small improvement over the years. But clearly the implication for MCFRS is that there needs to be a single method for measurement and reporting of ALS call processing times in order to benchmark current performance against past performance. Not having the measurement and reporting standardized makes it difficult to show the impact of any improvements.

Clawson, Dernocour and Rose (2008) describe the *60-second dilemma* in their textbook to stress that standards give the emergency medical dispatcher only 60 seconds to interrogate the 9-1-1 caller and make dispatch decisions. Clawson, et al. state that “very few, if any, medical professionals are required to consistently perform the evaluation and decision-making part of their patient care in 60 seconds” and that “there is no scientific rationale for the 60-second time frame” (p. 1.21). Clawson et al. would prefer an appropriate response to EMD questioning based on compliance with the protocol which “reduces the time required for evaluation through optimization of interrogation and decision processes” (p. 1.24). In other words, compliance with the protocol should result in reduction in the time it takes to use EMD, thus resulting in decreased overall call-processing times.

The results of this study compared EMD compliance scores with call processing times. Plotting the comparison graphically and by using the correlation coefficient calculation, it was shown that there is no correlation between EMD compliance scores and call processing time in Montgomery County. There was still no correlation when EMD compliance scores were compared to only the phone-to-pending interval, that portion of the 9-1-1 call processing time that contains the EMD function. The implication is clear from this comparison that compliance with EMD protocols has no effect on MCFRS call processing time. A high EMD compliance

score has the same effect on call processing times as a low compliance score. So from the perspective of time, there is no benefit to the EMD quality assurance function of compliance scoring. It seems that doing EMD right or wrong still produces a high call processing time; simply using EMD is a contributor to high call processing times for Montgomery County.

No other studies found during the literature search directly compared EMD compliance scores with call processing times. However the effects of simply instituting an EMD program on call processing times is well documented. Geare (1995) and Pendleton (1999) both determined that 9-1-1 call processing times increased after implementation of new EMD protocols. Olsen (2003) confirmed that using EMD for EMS events doubled the call processing times realized for fire events. And Wilcox (2007) more recently agrees that call processing times are prolonged by simply using EMD.

Since it is evident that the use of EMD prolongs 9-1-1 call processing times, then the use of EMD should also prolong overall EMS response time. The results of this study indicate that MCFRS meets the overall ALS response time standard 64% of the time. NFPA 1710 sets this overall ALS response time standard at 600 seconds (10 minutes), based on 60 seconds for call processing, 60 seconds for unit turnout, and 480 seconds for ALS unit travel. The results of this study also showed that if the 9-1-1 call processing interval was within the 60 seconds standard, then 14% more ALS calls would fall within the 600 second overall ALS response time standard. That would bring the compliance to 78%; but still the remaining 22% of events that are over the standard are due to prolonged ALS unit travel times. This indicates that even though the 9-1-1 call processing is a contributor to the problem, inadequate ALS unit deployment and resource utilization is the slightly greater contributor.

Other researchers looked the effects of EMD on ALS response. Wilcox (2007) was the only source found during the literature review that concurs with this research that prolonged call processing times when using EMD effects total EMS response times. Other researchers point to the value of EMD to improve EMS operations. Scofield (1995) concluded that adherence to the EMD protocols assured “that those in need of EMD service...receive prompt efficient help” (pp. 18-19). Bailey, O’Connor and Ross (2000) concluded that use of EMD decreased the number of inappropriate ALS dispatched. And Cady (2001) iterates that with the use of EMD protocols, EMS systems can “improve operational efficiencies” and “improve patient outcomes through more effective and efficient use of resources” (p. 57).

In order to minimize the facts that using EMD adds to the 9-1-1 call processing times, Clawson, Dernocoeur and Rose (2008) postulated the concept of *Zero-Minute Response*. Using this concept, the EMS response time clock is stopped prior to the arrival of first responders, because the emergency medical dispatcher is already providing pre-arrival and post-dispatch medical direction to the caller. Using this theory, the response time clock is effectively stopped during EMD; there would be no further need to measure call processing because the first responder would already be on the scene of the event, by way of medical direction to the caller over the telephone.

The implications from this research show that MCFRS needs to conduct EMD right, not just fast. The impact is just not speeding up the ALS response, but making sure that scarce ALS resources are used appropriately, so that when there is a life-threatening, time critical emergency there are ALS units available, deployed properly to assure a timely response.

Finally, comparing MCFRS 9-1-1 call processing times to other NCR jurisdictions, those jurisdictions reporting average ALS call processing times of 60 to 95 seconds are significantly

faster than the 169 seconds calculated for MCFRS. Compliance with meeting ALS call processing goals was reported in a range from 35% to 95%, compared with MCFRS at less than 1%. However it is important to note that the largest jurisdictions in the NCR, those with similar size and call volume as MCFRS, do not measure their call processing times. Also, those NCR jurisdictions reporting low call processing times do not use MPDS software; rather they use the manual card sets. This leads to the question about compliance with EMD protocols – are the jurisdictions using the manual card fully compliant with the protocols (i.e. asking all of the correct questions before selecting a determinant and sending the call to the dispatcher), or are they somehow bypassing the protocol to realize faster call processing times?

Murray (2000) suggests just that. He recommends an approach to speeding up the call processing time by bypassing EMD and just dispatching the closest unit with only the location of the event. After dispatching the event, call-takers would complete the EMD protocol and re-dispatch the event with the appropriate units. Some of the smaller jurisdictions in the NCR region are all-ALS systems, and they do just as Murray suggests. They dispatch an ALS unit to the event with just a nature and location, then they complete the EMD protocol and provide the ALS unit with more specific information about the nature of the event, as well as dispatching any additional units needed, and giving the caller pre-arrival or post-dispatch instructions. The implication to MCFRS is that in order to realize faster call processing times, the tiered EMS deployment model might need to be re-evaluated in favor of an all ALS transport unit system or an all-ALS engine system.

Recommendations

The purpose of this applied research project was to ascertain the magnitude of the failure of the MCFRS ECC to meet established goals for 9-1-1 call processing times and to determine

the impact of this failure on the overall delivery of emergency medical services. The research confirmed that the MCFRS fails to meet 9-1-1 call processing times, as compared to the standards of various sources such as the NFPA, ASTM and CPSE. This failure to meet the elusive 60-second 9-1-1 call processing standards has a significant impact on the total response times for ALS events in Montgomery County. The following recommendations suggest action that MCFRS, or any other similar fire service organization, should consider to reduce 9-1-1 call processing times and its impact on delivery of EMS.

First, MCFRS should decide which standard for 9-1-1 call processing and response times it will benchmark performance against. It is recommended that MCFRS benchmark against the totality of NFPA 1710 and 1221 for the overall response times for ALS events including call processing, turnout time, and travel time. These standards are fractile standards, set at 90%, which show a better picture of the overall performance than do measurements using averages. Additionally, the NFPA standards will allow MCFRS to benchmark only the most time-critical events such as the MPDS Echo level ALS events. These standards will also allow MCFRS to modify the data to exclude outliers such as TTD/TTY calls and language line use. Publishing this data on a monthly basis will be a more useful tool to use to analyze overall system performance (time) on those events when time really is a critical factor. Even though it is recommended that the NFPA standards be used, the ASTM standard (120 seconds for call processing) should be used as an additional consideration when evaluating the performance of EMD within the 9-1-1 call processing process. These new response time benchmarks MCFRS need to be published for use by the *Master Plan*, *Strategic Plan*, CountyStat and ECC internal program measures.

Second, MCFRS should perform a critical analysis of its work-flow during the entire process of 9-1-1 call-taking. There is data presented in this research to suggest that the function of EMD adds to the call-taking process. But what is not known is the percentage of the overall 9-1-1 call taking processing is consumed by EMD, and what other parts of the process consume beyond what the NFPA and ASTM standards allow. This would include an analysis of the MPDS. And as the CPSE suggests, MCFRS needs to perform an analysis of call processing procedures and alternate methods of using EMD. Therefore it is recommended that MCFRS continue the process of creating a request for proposal (RFP) and hiring a consultant to conduct a workflow mapping and critical analysis of the workflow processes of 9-1-1 call processing in order to determine where the time wasters are in the overall process.

Third, MCFRS needs to perform a critical analysis of the MPDS system, in order to determine if this product is the best match for the MCFRS system. There are other EMD products on the market, both electronic and card sets, which might allow for faster caller interrogation than the MPDS product. Other jurisdictions in the NCR have achieved faster results than MCFRS by using these other products. Currently, the Police ECC is investigating a software product for use for police caller interrogation and prioritization of calls that integrates modules for fire and EMS call-taking. This may be a product worth investigating as a replacement for the MPDS.

Fourth, MCFRS needs to partner with the Police ECC in investigation a new CAD product. There has been some unsubstantiated blame for the slow 9-1-1 call processing times on the CAD. But nonetheless, the current Altair CAD has reached the end of its life-cycle and should be promptly replaced with a more modern CAD. The CPSE recommends that MCFRS

purchase a new CAD to process and dispatch calls faster. It is recommended that 9-1-1 call processing times performance standards be included in the RFP for the new CAD.

Finally, MCFRS needs to reevaluate its EMS deployment strategies. As the *Master Plan* suggests, deployment of EMS resources is a contributing factor in the overall EMS response times. The CPSE also recommended that MCFRS review its tiered EMS response strategy. Other jurisdictions that have achieved faster 9-1-1 call processing time and are able to meet the standards deploy an all ALS ambulance fleet. Thus, as Murray (2000) suggests, the ALS ambulance can be dispatched as soon as an address of the caller is determined (reduced call processing) and then come back to the caller to perform EMD to reassess the priority of the event and provide dispatch life support to the caller. Additionally, the current deployment of ALS ambulances causes long travel times such as this research suggests. Twenty-two percent of Delta and Echo events do not meet the overall ALS response time goals because travel time exceeds the allotted 480 seconds by NFPA standards.

Future research is needed on 9-1-1 call processing times. Much of the research in the NFA LRC is dated, so additional applied research projects from jurisdictions similar to MCFRS are needed to validate the results of this research. In addition, more research is needed on EMD, to determine the effects of the EMD interval on the overall 9-1-1 call processing times and to determine a national baseline for EMD processing times so that systems like MCFRS can benchmark their performance. More research is also needed to discover the specific causes of slow or substandard 9-1-1 call processing times.

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Appendix

Call Processing Time Questionnaire

1. What is the name of your agency?
2. Do you use Civilian or Uniformed call takers?
3. Do you use Agency-Specific or Common (unified) call takers?
4. Which CAD do you use?
5. If you use EMD, which product do you use? Software or Cards?

6. What is your average EMD processing time for ALS events?

(EMD processing time defined as the time interval from launch of the EMD product to sending the initial call type to CAD)

7. What is your average call processing time for ALS events? For structure fires?

(Call processing times defined as the time interval from receipt of 911 call to dispatch NFPA 1701/1221)

8. Do you define call processing time differently than NFPA 1701/1221?
9. What percentage of the time does your agency meet your call processing time goals for ALS events? For Structure fires?

Please provide contact information for any follow-up questions